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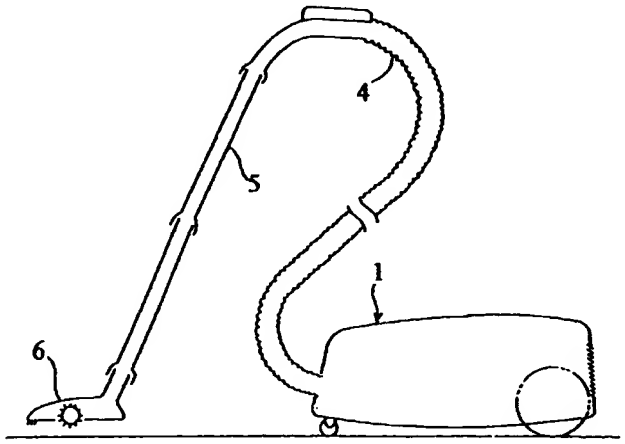
(54) Detection device for sensing and displaying the filling state of a dust bag in a vaccum cleaner

(57) A vacuum cleaner sucks dust with air to a vacuum cleaner body(1) through a suction pipe(4) and collects only dust by a dust bag(2), comprises control section(72) and a generator(71) both being provided within an operation section(7) which is provided at a predetermined position of the suction pipe(4), which generator(71) is driven by an air sucked to the suction pipe(4) from outside through the operation section(7) so as to generate an electric power, and further comprises a collected dust quantity detection and display section(81, 82, 83, 84, 85) included within the control section(72) which compares the generated electric power with a predetermined electric power so as to obtain a comparison result, detects a quantity of dust within the dust bag(2) based upon the comparison result, and displays a detection result of the quantity of dust.

Fig.1



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Description

Background of The Invention

The present invention relates to a vacuum cleaner. More particularly, the present invention relates to a vacuum cleaner which detects a condition that a dust bag is full with sucked dust.

From past, an arrangement of a vacuum cleaner is popularly employed that an air intake and an air outlet are provided at a vacuum cleaner body and a dust bag and a fan motor are provided at predetermined positions at an interior of the vacuum cleaner body. Specifically, the fan motor is disposed by being maintained its outer periphery by an airtight packing.

When the vacuum cleaner having the above arrangement is employed, a suction force (negative pressure) is generated by the fan motor, an air including dust is sucked by the suction force through a suction nozzle, a suction pipe and the air intake, the dust is collected by the dust bag while the air penetrates the air bag and is exhausted through the air outlet to an exterior of the vacuum cleaner body. Therefore, a quantity of dust collected by the dust bag increases by performing cleaning operation intermittently or continuously for a long time period, and the dust bag approaches a full condition with collected dust.

When the dust bag is filled with sucked dust, the dust bag is blinded and an air penetration ability of the dust bag is lost. Therefore, the suction force due to the fan motor is not transmitted to the air intake so that a condition is realized that an air is scarcely sucked (cleaning is scarcely performed). Consequently, the collected dust within the dust bag is to be removed from the dust bag when such a condition is realized.

Further, a mechanism (dust quantity display mechanism) for detecting a condition that the dust bag is filled with collected dust is provided at the conventional vacuum cleaner.

The mechanism includes a casing 41 having a rectangular parallelepiped shape, cylindrical shape or the like and a communicating pipe 42 provided at a wall member of the casing 41 which wall member is at one side in a longitudinal direction of the casing 41. The communicating pipe 42 communicates an interior of the casing 41 and a space (rear space of the dust bag) between the vacuum cleaner body and the dust bag, as is illustrated in Fig. 8. A display body 44 is housed within the casing 41 in a slidable manner and a spring 45 for energizing the display body 44 so that the display body 44 is slid in a direction for aparting from the communicating pipe 42. Further, a transparent window 43 is provided at a predetermined position of a wall member which is parallel to a moving direction of the display body 44. The transparent window 43 is used for visually recognize a position of the display body 44. A collected dust quantity display (for example, empty, medium and full) 46 for indicating a collected dust quantity is provided at a predetermined position of the casing 41 which position is adjacent to the window 43, as is illustrated in Fig. 9.

When this arrangement is employed, and when a quantity of dust collected within the dust bag is nearly 0, a large quantity of air sucked through the air intake by the fan motor which is rotated at high speed, so that a negative pressure within the rear space of the dust bag becomes extremely small. Therefore, the display body 44 is at a condition that the display body 44 is moved by the spring 45 so that a display is performed that a quantity of dust collected within the dust bag is nearly 0 (refer to the display body 44 and the collected dust quantity display 46 in Fig. 9).

On the contrary, when the dust bag is filled with sucked dust, a quantity of sucked air through the air intake is almost 0 even when the fan motor rotates at extremely high speed, so that a negative pressure within the rear space of the dust bag becomes extremely great. Therefore, the display body 44 is moved against the force of the spring 45 so that a display is performed that the dust bag is filled with sucked dust.

Further, when a quantity of dust collected within the dust bag is an intermediate quantity of the above both quantities, a negative pressure within the rear space of the dust bag varies in correspondence to a quantity of collected dust. Therefore, the display body 44 is moved in correspondence to the amount of negative pressure and the force of the spring 45 so that a quantity of dust collected within the dust bag is displayed.

The dust quantity display mechanism having the above arrangement is a mechanism which is quite different from a cleaning function which is an essential function of a vacuum cleaner. Therefore, providing the dust quantity display mechanism is performed by adding an extra mechanism to the vacuum cleaner. Consequently, a disadvantage arises that a manufacturing cost of a vacuum cleaner is increased.

Further as is apparent from the above description of operations of the vacuum cleaner, the dust quantity display mechanism should be disposed at the vacuum cleaner body. A disadvantage arises that visually recognizing the dust quantity display mechanism becomes inconvenient and forced condition for a cleaning operator. More particularly, a cleaning operator actually performing a cleaning operation performs a cleaning operation with looking at an operating section and the like which is provided at the suction nozzle or the suction pipe. And, during the cleaning operation, the vacuum cleaner body moves in a pulled manner by the suction pipe. Therefore when the dust quantity display mechanism is to be visually recognized, an operator should look back and look at the vacuum cleaner body and the operator should look into the transparent window 43 having an extremely small size in comparison to a size of the vacuum cleaner body. Consequently, visually recognizing the dust quantity display mechanism

gives inconvenience and forced condition to a cleaning operator.

It is an object of the present invention to decrease a manufacturing cost of a vacuum cleaner.

It is another object of the present invention to visually recognize a dust quantity display mechanism without giving inconvenience and forced condition to a cleaning operator.

Summary of The Invention

A vacuum cleaner according to the present invention comprises a vacuum cleaner body and a suction pipe connected to the vacuum cleaner body, wherein the suction pipe guides dust with air to the vacuum cleaner body and has an operation section at a predetermined position thereof, the vacuum cleaner body includes therein has a fan motor for generating a suction force for sucking dust with air and a dust bag for collecting only dust among guided air and dust by the suction force, the operation section includes a generator and a control section which generator is driven by an air sucked by the suction force to the suction pipe from exterior of the operation section through the operation section so that an electric power is generated, the control section includes a collected dust quantity detection and display means which compares the generated electric power and a predetermined electric power so as to obtain a comparison result, detects a quantity of dust within the dust bag based upon the comparison result so as to obtain a detection result and displays the detection result.

When the vacuum cleaner having the above arrangement is employed, dust with air is guided to an interior of the vacuum cleaner body through the suction pipe by operating the fan motor. Therefore, only dust is collected within the dust bag and the generator is operated so that an electric power is generated.

When a quantity of dust within the dust bag is small, an air smoothly passes through the dust bag so that a quantity of air sucked by the suction force from the exterior of the operation section to the suction pipe through the operation section is greater and an electric power generated by the generator becomes greater. On the contrary, when a quantity of dust within the dust bag is great, an air does not smoothly pass through the dust bag so that a quantity of air sucked by the suction force from the exterior of the operation section to the suction pipe through the operation section is smaller and an electric power generated by the generator becomes smaller.

Therefore, the collected dust quantity detection and display means detects a quantity of dust within the dust bag based upon the generated electric power of the generator which electric power varies depending upon a quantity of dust within the dust bag, and displays the detection result.

As is apparent from the foregoing, the collected dust quantity detection and display means detects and displays a quantity of dust electrically, a limitation that the means should be provided at the vacuum cleaner body such as a conventional mechanism does not exist at all and the means can be provided at a desired position of the vacuum cleaner. Consequently, a manufacturing cost of a vacuum cleaner is decreased, and a dust quantity display is visually recognized without giving inconvenience and forced condition to a cleaning operator.

Brief Description of The Drawings

Figure 1 is a schematic view of a vacuum cleaner to which the present invention is applied,

Figure 2 is a schematic cross sectional view illustrating an interior of a vacuum cleaner body,

Figure 3 is a schematic cross sectional view illustrating an interior of an operation section casing,

Figure 4 is a block diagram illustrating an electric arrangement of an example of a dust quantity detection and display apparatus for detecting a quantity of dust within a dust bag,

Figure 5 is a diagram illustrating a relationship between a negative pressure and an output current of a turbine generator,

Figure 6 is a block diagram illustrating an electric arrangement of another example of a dust quantity detection and display apparatus,

Figure 7 is an electric circuitry diagram in correspondence to Fig. 5,

Figure 8 is a cross sectional view illustrating a conventional dust quantity display mechanism, and

Figure 9 is a plan view of the conventional dust quantity display mechanism.

Detailed Description of The Preferred Embodiments

Fig. 1 is a schematic view of a vacuum cleaner to which the present invention is applied, while Fig. 2 is a schematic cross sectional view illustrating an interior of a vacuum cleaner body.

The vacuum cleaner includes a vacuum cleaner body 1 which has a dust bag 2 and a fan motor 3 in an interior of the vacuum cleaner body 1, a suction pipe 4 which is connected to the vacuum cleaner body 1 in a removable manner, an extension pipe 5 which is connected to the suction pipe 4 in a removable manner and a suction nozzle 6 which is connected to a leading edge section of the extension pipe 5 in a removable manner.

The vacuum cleaner body 1 has a first air intake 11 at its one edge section and an air outlet 12 at its other edge section. Within the vacuum cleaner body 1, the dust bag 2 is disposed in a first air intake side in a removable manner and the fan motor 3 which is maintained with an airtight packing 3a is disposed in an air outlet side. A space between the dust bag 2 and the fan motor 3 is a rear space 2a of the dust bag.

The suction pipe 4 has an operation section casing 7 at its predetermined position. The operation section casing 7 houses a turbine generator 71 and a printed circuit board 72 as is illustrated in Fig. 3. The operation section casing 7 has a second air intake 73 for sucking an air which is used for drive the turbine generator 71. The suction pipe 4 has an air passage 74 for guiding an air within the suction pipe 4 which air has already driven the turbine generator 71. Further, the operation section casing 7 has a light emitting device 75 at its predetermined position. The turbine generator 71 supplies an electric power for operation to a electric circuitry mounted on the printed circuit board 72, the light emitting device 75 and the like.

Fig. 4 is a block diagram illustrating an electric arrangement of an example of a dust quantity detection and display apparatus for detecting a quantity of dust within the dust bag.

In the dust quantity detection and display apparatus, an output current of the turbine generator 71 is detected by an output current detection section 81 so as to obtain a detection result, the detection result is supplied to a full display ON/OFF section 83 by intervening a time constant circuitry 82. An oscillation section 84 is controlled its operation by an output signal of the full display ON/OFF section 83. An oscillation output of the oscillation section 84 is supplied to a driver section 85 so that the light emitting device 75 is operated and a condition is displayed that the dust bag 2 is filled with dust.

The output current detection section 81 detects the output current of the turbine generator 71 whether or not the output current is smaller than a predetermined value. The time constant circuitry 82 includes one or more condensers which are charged or discharged responding to a detection result signal of the output current detection section 81. The full display ON/OFF section 83 is controlled by a voltage between both terminals of one of the condensers. The full display ON/OFF section 83 controls the oscillation section 84 based upon its output signal whether or not the oscillation section 84 is to be operated.

An operation of the vacuum cleaner having the above arrangement is as follows.

When the fan motor 3 is driven by operating a power switch (not illustrated), dust is sucked with air to the dust bag 2 through the suction nozzle 6, the extension pipe 5, the suction pipe 4 and the first air intake 11. The air passes through the dust bag 2 so that only dust is collected by the dust bag 2. An interior of the suction pipe 4 becomes a negative pressure condition by the above air flow, so that an air is sucked to the interior of the suction pipe 4 through the second air intake 73 and the air passage 74. The turbine generator 71 is rotated by the sucking air flow so as to output a current in correspondence to a rotation speed. The negative pressure and the output current have a relationship that the output current increases following an increase of the negative pressure, as is illustrated in Fig. 5. Further, the negative pressure increases following an increase of suction force due to the fan motor 3.

When a quantity of dust within the dust bag 2 is small, an air passing ability of the dust bag 2 is high, and a suction force of a suction path comprising the suction nozzle 6, the extension pipe 5, the suction pipe 4 and the first air intake 11 is great. Therefore, the output current of the turbine generator 71 is great.

When a quantity of dust within the dust bag 2 increases, the air passing ability of the dust bag 2 is lowered, and the suction force of the suction path comprising the suction nozzle 6, the extension pipe 5, the suction pipe 4 and the first air intake 11 becomes smaller. Therefore, the output current of the turbine generator 71 becomes smaller.

When the output current detection section 81 detects a condition that the output current of the turbine generator 71 becomes smaller than the predetermined value, the quantity of dust within the dust bag 2 is greater than a predetermined quantity. Therefore, one or more condensers of the time constant circuitry 82 are charged or discharged responding to the detection result signal of the output current detection section 81, and the full display ON/OFF section 83 is controlled by the voltage between both terminals of one of the condensers. The full display ON/OFF section 83 operates the oscillation section 84 by its output signal, then operates the light emitting device 75 by intervening the driver section 85 so that the light emitting device 75 displays a condition that the dust bag 2 is full with dust. The light emitting device 75 is provided at the predetermined position of the operation section casing 7, so that a cleaning operator can visually recognize a condition that the dust bag 2 is full with dust with a posture which is a normal posture for performing cleaning operation without giving inconvenience and forced condition such as looking back to the cleaning operator. Of course, the dust quantity detection and display apparatus does not require a complicated mechanical construction such as a conventional dust quantity display mechanism so that a cost of the dust quantity detection and display apparatus is decreased and a manufacturing cost of a vacuum cleaner is decreased.

Therefore, a disadvantage is prevented from occurrence that a cleaning operation is continuously performed even when the dust bag 2 is full with dust and a scarce suction force is realized.

Fig. 6 is a block diagram illustrating an electric arrangement of another embodiment of a dust quantity detection and display apparatus.

This dust quantity detection and display apparatus differs from the above dust quantity detection and display apparatus in that a dust sensor 91 comprising a light emitting device and a light receiving device is further provided, the light emitting device 75 is also driven based upon a detection result of the dust sensor 91, a dust sensor stopping section 92 is further provided

which operates based upon the output signal of the full display ON/OFF section 83 and stops a dust detection operation of the dust sensor 91.

Fig. 7 is an electric circuitry diagram in correspondence to the block diagram of Fig. 6. Further, an arrangement section corresponding to the dust sensor 91 is not illustrated in Fig. 7.

In the output current detection section 81, a zener diode ZD1 and a pair of forward diodes D1 and D2 are connected in series between output terminals of the turbine generator 71. A resistor R1 is connected in parallel to the pair of forward diodes D1 and D2. Further, a connection point of the zener diode ZD1 and the diode D1 is determined to be a ground GND of the dust sensor 91.

In the time constant circuitry 82, a resistor R3 and a collector-emitter terminals of a transistor Q1 are connected in series between the output terminals of the turbine generator 71. A resistor R2 is connected between a base terminal of the transistor Q1 and the connection point of the zener diode ZD1 and the diode D1. A condenser C1 is connected between the base terminal and the emitter terminal of the transistor Q1. A resistor R4 and a condenser C2 are connected in series between the collector terminal and the emitter terminal of the transistor Q1.

In the full display ON/OFF section 83, resistors R and R5 and collector-emitter terminals of a transistor Q2 are connected in series between the output terminals of the turbine generator 71. An emitter terminal of a transistor Q4 is connected to the ground GND of the dust sensor 91. A diode D3 is forward-connected between a connection point of the resistor R4 and the condenser C2 and a base terminal of the transistor Q2. A diode D4 is reverse-connected between a connection point of the resistors R6 and R5 and the ground GND of the dust sensor 91. A resistor R8 is connected between a base terminal of the transistor Q4 and the connection point of the resistors R6 and R5. A resistor R10 is connected between a collector terminal of the transistor Q4 and a plus output terminal of the turbine generator 71.

In the oscillation section 84, a resistor R11 and collector-emitter terminals of a transistor Q5 are connected in series between the plus output terminal of the turbine generator 71 and the ground GND of the dust sensor 91. A resistor R13 and collector-emitter terminals of a transistor Q6 are connected in series between the plus output terminal of the turbine generator 71 and the ground GND of the dust sensor 91. A base terminal of the transistor Q5 is connected to the collector terminal of the transistor Q4. A condenser C4 is connected between the base terminal of the transistor Q5 and the collector terminal of the transistor Q6. A condenser C3 is connected between a base terminal of the transistor Q6 and the collector terminal of the transistor Q5. A resistor R12 is connected between the plus output terminal of the turbine generator 71 and the base terminal of the transistor Q6.

In the driver section 85, an emitter terminal of a transistor Q7 is connected to the ground GND of the dust sensor 91. A base terminal of the transistor Q7 is connected to the collector terminal of the transistor Q6 by intervening a resistor R14. A collector terminal of the transistor Q7 is connected to a cathode of the light emitting device 75 included within the dust sensor 91 by intervening a resistor R15.

In the dust sensor stopping section 92, an emitter terminal of a transistor Q3 is connected to the ground GND of the dust sensor 91. A base terminal of the transistor Q3 is connected to the collector terminal of the transistor Q2 by intervening a resistor R7. A collector terminal of the transistor Q3 is connected to the plus output terminal of the turbine generator 71 by intervening a resistor R9. An emitter terminal of a transistor Q8 is connected to the ground GND of the dust sensor 91. A base terminal of the transistor Q8 is connected to the collector terminal of the transistor Q3. A collector terminal of the transistor Q8 is connected to a plus input terminal of an operational amplifier (not illustrated) included within the dust sensor 91.

An operation of the dust quantity detection and display apparatus having the above arrangement is as follows.

When the fan motor 3 is driven by operating a power switch (not illustrated), dust is sucked with air to the dust bag 2 through the suction nozzle 6, the extension pipe 5, the suction pipe 4 and the first air intake 11. The air passes through the dust bag 2 so that only dust is collected by the dust bag 2. An interior of the suction pipe 4 becomes a negative pressure condition by the above air flow, so that an air is sucked to the interior of the suction pipe 4 through the second air intake 73 and the air passage 74. The turbine generator 71 is rotated by the sucking air flow so as to output a current in correspondence to a rotation speed. The negative pressure and the output current have a relationship that the output current increases following an increase of the negative pressure, as is illustrated in Fig. 5. Further, the negative pressure increases following an increase of suction force due to the fan motor 3.

When a quantity of dust within the dust bag 2 is small, an air passing ability of the dust bag 2 is high, and a suction force of a suction path comprising the suction nozzle 6, the extension pipe 5, the suction pipe 4 and the first air intake 11 is great. Therefore, the output current of the turbine generator 71 is great.

In this case, a voltage between both terminals of the resistor R1 of the output current detection section 81 increases following the output current being great. When the voltage between both terminals of the resistor R1 reaches a first predetermined voltage (for example, about 0.6 volts), the transistor Q1 turns on so that the condenser C2 is discharged. As a result, the transistor Q2 turns off so that the transistors Q3 and Q4 turn on. The transistor Q8 turns off as a result of the transistor Q3 being turned on, so that the dust sensor 91 oper-

ates. The dust sensor 91 detects a quantity of dust included within an suction air sucked through the suction nozzle 6, the extension pipe 5, the suction pipe 4 and the first air intake 11. The dust sensor 91 drives the light emitting device 75 so as to visually display the quantity of dust.

During the above operation being performed, the transistor Q4 is turned on so that the oscillation section 84 does not operate. Therefore, the above operation of the light emitting device 74 is not influenced at all.

When a quantity of dust within the dust bag 2 is increased by performing cleaning operation, the air passing ability of the dust bag 2 is lowered so that the suction force through the suction path comprising the suction nozzle 6, the extension pipe 5, the suction pipe 4 and the first air intake 11 and the output current of the turbine generator 71 becomes smaller.

Even when the operation is performed, an operation which is similar to the above operation is performed when the voltage between both terminals of the resistor R1 reaches the first predetermined voltage.

On the contrary, when the voltage between both terminals of the resistor R1 does not reach the first predetermined voltage, the transistor Q1 is maintained to be off so that the condenser C2 is charged. When a voltage between both terminals of the condenser C2 reaches a second predetermined voltage (for example, about 1.2 volts), the transistor Q2 turns on so that the transistors Q3 and Q4 turn off. When the transistor Q3 turns off, the transistor Q8 turns on so that the dust sensor 91 is stopped its operation.

Further, when the transistor Q4 turns off, the condenser C4 is charged. When a voltage of the base terminal of the transistor Q5 reaches a third predetermined voltage (for example, about 0.6 volts), the transistor Q5 turns on and the transistor Q6 turns off. Under this condition, the condenser C3 is charged. When a voltage of the base terminal of the transistor Q6 reaches the third predetermined voltage, the transistor Q6 turns on and the transistor Q5 turns off. Thereafter, charging of the condenser C4, charging of the condenser C3 and turning on and turning off of the transistors Q5 and Q6 in correspondence to the charging are repetitively performed so that the oscillation section 84 outputs a signal which varies its level periodically. During the transistor Q6 being turned off, the transistor Q7 turns on so that the light emitting device 75 is driven. Therefore, a display indicating the dust bag 2 being full with dust is performed.

Consequently, a disadvantage is prevented from occurrence that cleaning operation is continued even when the dust bag 2 is full with dust and when scarce suction force is realized.

Further, the dust quantity detection and display apparatus employs the time constant circuitry 82. Therefore, even when the output current of the turbine generator 71 momentary reaches a value which represents the dust bag 2 being full with dust, and when the output current does not continue for a time to some degree, a display indicating the dust bag 2 being full with dust is not performed so that a mis-operation is securely prevented from occurrence.

As is apparent from the foregoing description, the dust quantity detection and display apparatus does not require a complicated mechanical arrangement such as a conventional dust quantity display mechanism, and the light emitting device 75 is used both as displaying the dust bag 2 being full with dust and displaying a quantity of sucking dust. Therefore, a further decrease in cost of the dust quantity detection and display apparatus is realized and a manufacturing cost of a vacuum cleaner is decreased.

Claims

1. A vacuum cleaner comprising;

   a vacuum cleaner body(1) , and
   a suction pipe(4) connected to the vacuum cleaner body(1),
   wherein the suction pipe(4) guides dust with air to the vacuum cleaner body(1) and has an operation section(7) at a predetermined position thereof,
   the vacuum cleaner body(1) includes therein a fan motor(3) for generating a suction force for sucking dust with air and a dust bag(2) for collecting only dust among guided air and dust by the suction force,
   the operation section(7) includes a generator(71) and a control section(72) which generator(71) is driven by an air sucked by the suction force to the suction pipe(4) from exterior of the operation section(7) through the operation section(7) so that an electric power is generated, and
   the control section(72) includes a collected dust quantity detection and display means(81, 82, 83, 84, 85) which compares the generated electric power and a predetermined electric power so as to obtain a comparison result, detects a quantity of dust within the dust bag(2) based upon the comparison result so as to obtain a detection result and displays the detection result.

2. A vacuum cleaner as set forth in claim 1, wherein the collected dust quantity detection and display means(81, 82, 83, 84, 85) compares the generated electric power with a predetermined electric power so as to obtain a comparison result, judges whether or not the comparison result continues for more than a predetermined time, detects a quantity within the dust bag(2) based upon the comparison result which is judged to be continued for more than the predetermined time so as to obtain a detection

result, and displays the detection result.

3. A vacuum cleaner as set forth in claim 1, further comprising a dust sensor(91) for detecting a quantity of dust which is sucked with an air, and a display device(75) for visually displaying a detection result obtained by the dust sensor(91), and wherein the collected dust quantity detection and display means(81, 82, 83, 84, 85) detects a quantity of dust within the dust bag(2) so as to obtain a detection result and a judgment result judging whether or not the dust bag(2) is full with dust, stops an operation of the dust sensor(91) responding to the judgment result representing the dust bag(2) being full with dust, and drives the display device(75) so as to display the detection result.

4. A vacuum cleaner as set forth in claim 3, wherein the dust sensor(91) continuously turns the display device(75) on, while the collected dust quantity detection and display means(81, 82, 83, 84, 85) intermittently turns the display device(75) on.

Fig.1

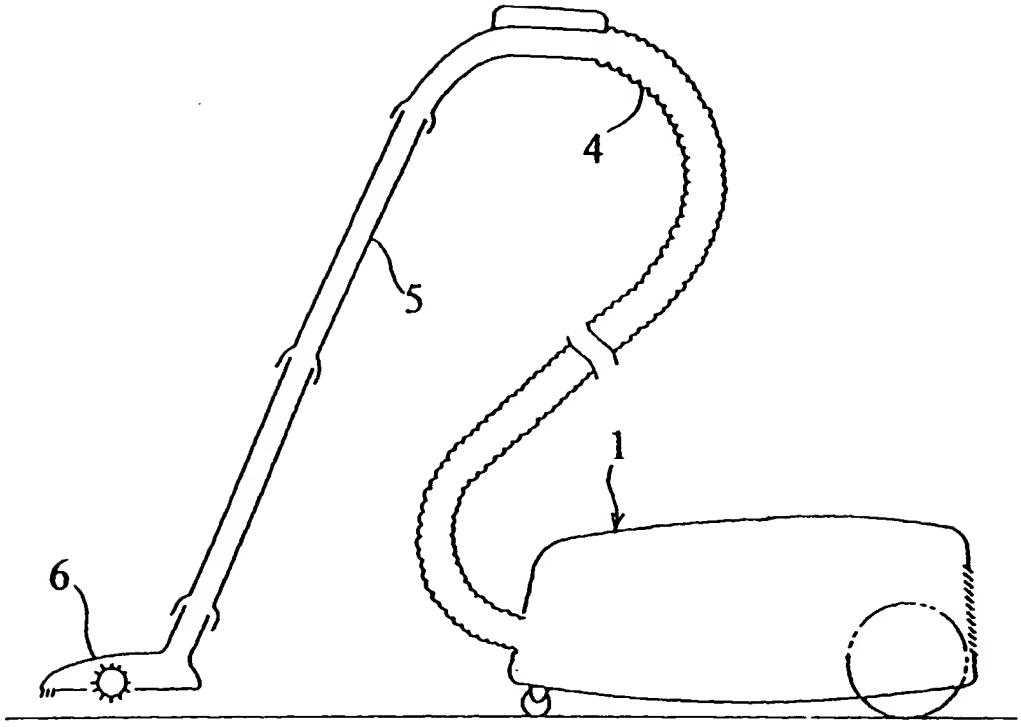


Fig.2

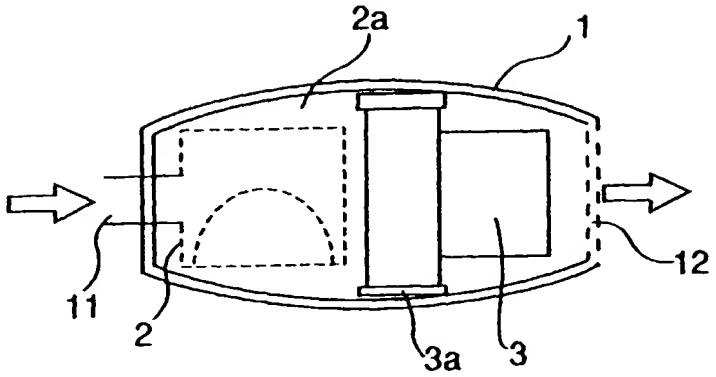


Fig.3

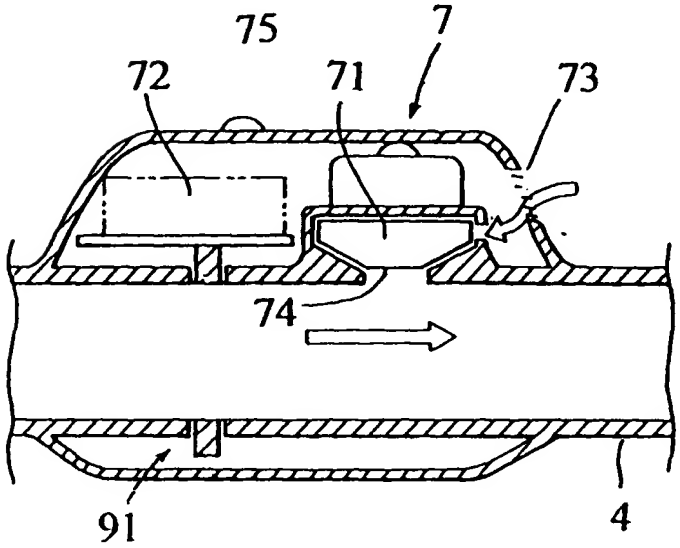


Fig.4

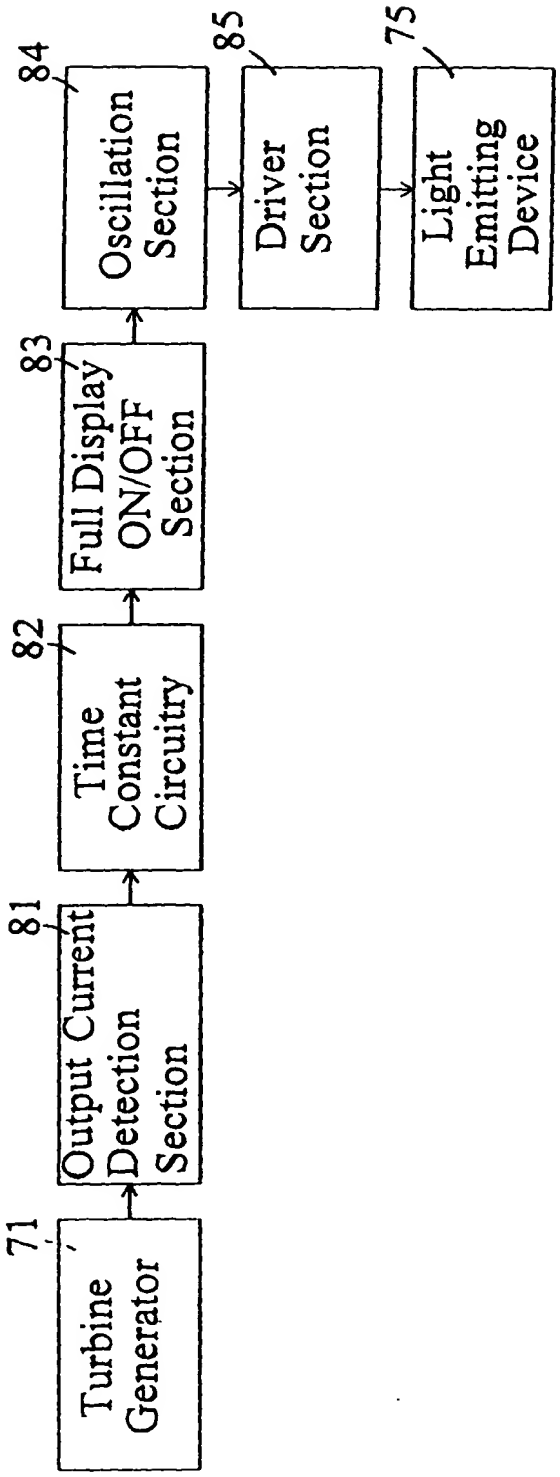

71
Turbine Generator
81
Output Current Detection Section
82
Time Constant Circuitry
83
Full Display ON/OFF Section
84
Oscillation Section
85
Driver Section
75
Light Emitting Device

Fig.5

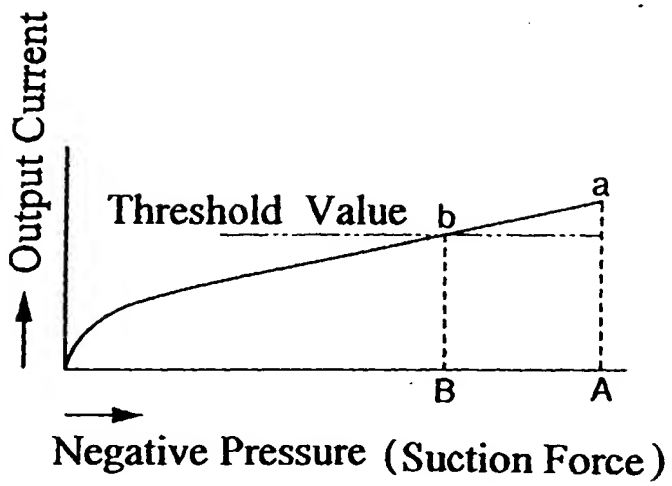

Output Current
Threshold Value
a
b
B
A
Negative Pressure (Suction Force)

Fig.6

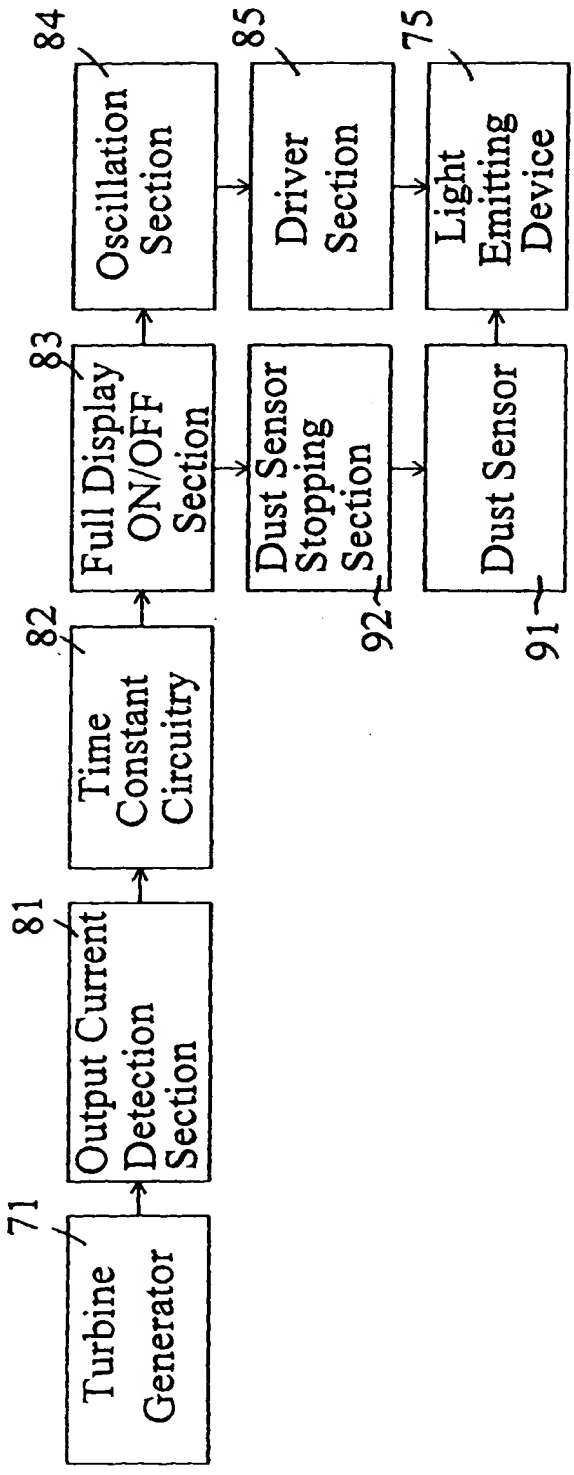
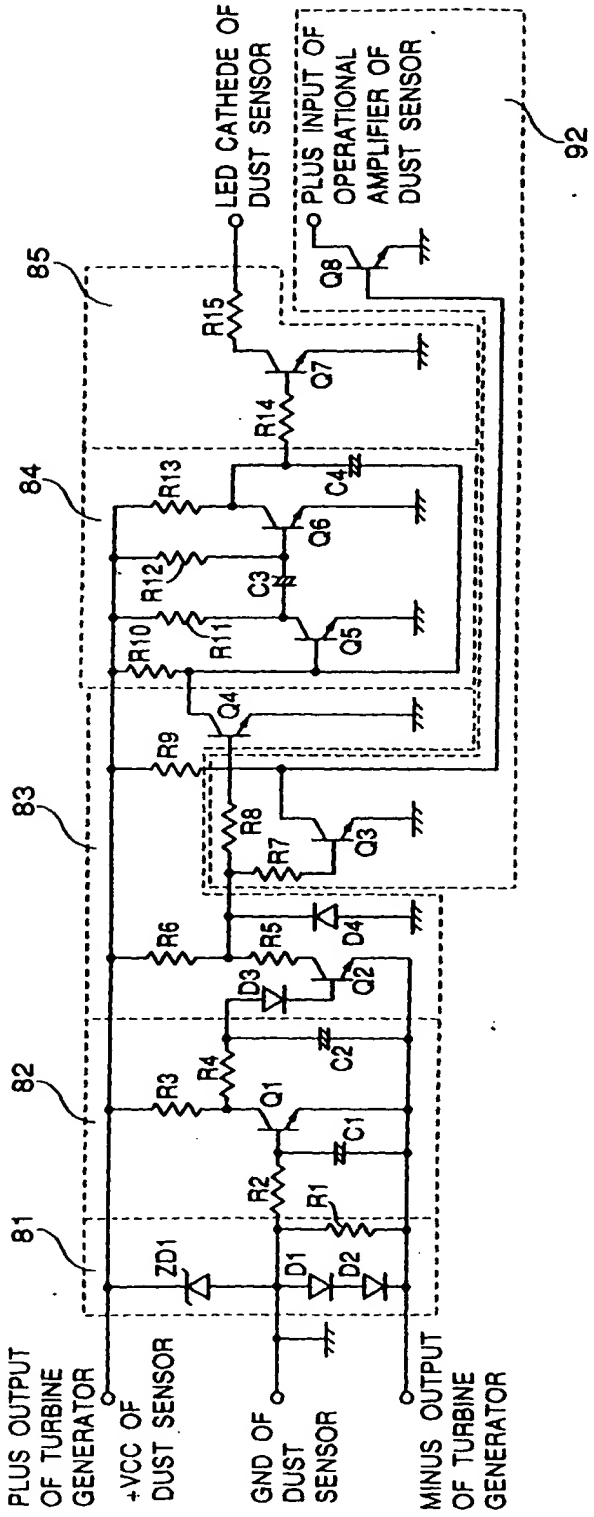

71
Turbine Generator
81
Output Current Detection Section
82
Time Constant Circuitry
83
Full Display ON/OFF Section
84
Oscillation Section
85
Driver Section
75
Light Emitting Device
92
Dust Sensor Stopping Section
91
Dust Sensor

Fig.7


PLUS OUTPUT OF TURBINE GENERATOR
+VCC OF DUST SENSOR
GND OF DUST SENSOR
MINUS OUTPUT OF TURBINE GENERATOR
LED CATHEDE OF DUST SENSOR
PLUS INPUT OF OPERATIONAL AMPLIFIER OF DUST SENSOR
81
82
83
84
85
92
ZD1
D1
D2
D3
D4
R1
R2
R3
R4
R5
R6
R7
R8
R9
R10
R11
R12
R13
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Q3
Q4
Q5
Q6
Q7
Q8

Fig.8

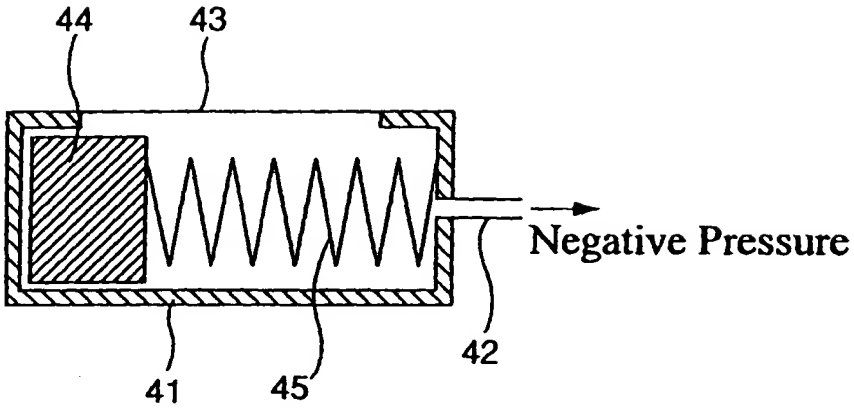
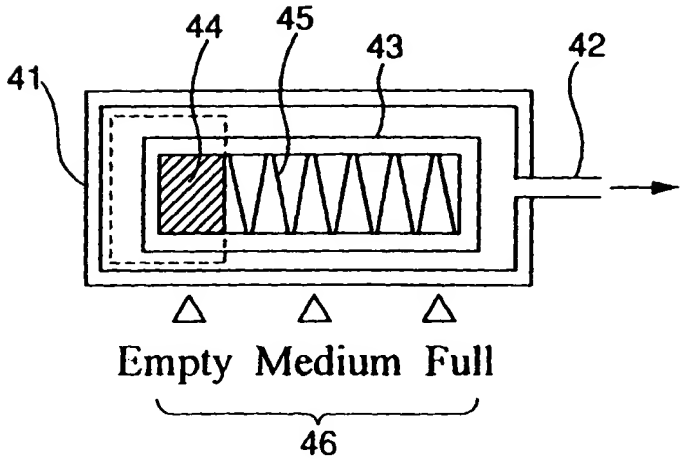

44
43
Negative Pressure
42
41
45

Fig.9


44
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41
Empty
Medium
Full
46

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 97 10 5854

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
Y	US 5 033 151 A (KRAFT MANFRED ET AL) 23 July 1991 * column 1, line 22-34 * * column 3, line 39-54 * * column 5, line 61 - column 6, line 66 * * column 7, line 8-28; figure 1 *	1	A47L9/19
A		2-4	
Y	EP 0 584 743 A (YASHIMA ELECTRIC CO LTD OF ISH) 2 March 1994 * column 5, line 42-58 * * column 6, line 23-30 * * column 6, line 51 - column 7, line 28 * * column 14, line 31-33 * * figure 2 *	1	
A	US 4 240 072 A (FOWLER THOMAS P) 16 December 1980 * the whole document *	1	
			TECHNICAL FIELDS SEARCHED (Int.Cl.6) A47L

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
MUNICH	9 October 1997	Laue, F

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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